Part III. Annual Cycle Data and Anomaly

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Goal: The goal for this tutorial is to show how to create annual cycle cdms data and easily calculate anual cycle anomaly, then plot it and write to a NetCDF file.Â Â

The strategy:

5) merge masked sstÂ with maskedÂ tasÂ and create the cdms variable with the lat, lon, time definitions from 1) .

6) usingÂ cdutilÂ createÂ the annualcyle.climatologyÂ variable and calculate the anomalies

7) create the cdms variable with the anomalies field and lat, lon, time definitions from 1) , apply same as in 1) spatial missing mask , and write the resulting data to an output NetCDF file.

5) merge masked 'sst' and 'tas' variables, create cdms variable .

Add masked sea ('sst') and land ('tas')Â data. So far they are defined as a numeric arrays.
We will create a cdms variable and add metadata to it. We will use lat, lon, and time definitions fromÂ 1)Â (see Part I)

```
# add land and ocean contributions for the merged product
merged=masked_sst+masked_tas
# add metadata to this numeric array

merged=cdms.createVariable(merged,axes=(tim,lat,lon),
             typecode='f',id='merged_tas_sst')
merged.id='merged_tas_sst'
merged.set_fill_value(1e20)
cdutil.setTimeBoundsMonthly(merged)
```

Plot the merged data

```
x=clear()
x.plot(merged)
```

Now create NetCDF output file with the name 'era40_merged_tas_sst.nc' and write the merged data.

```
# write out the total temperature data to a netcdf file
o=cdms.open('era40_merged_tas_sst.nc','w')
o.write(merged)
```

Â **6**)Â create annual cycle data and calculate anomaly

We want to match the data in 1) so we need to calculate annual cycle for the time in the data 1) and subtract it from the data to calculate the anomaly.

```
# crete base period 1991-1993, inclusive
start_time = cdtime.comptime(1991,1,1)
end_time   = cdtime.comptime(1993,12,1)
```

Define the annual cycle

```
# the annualcycle

ac=cdutil.ANNUALCYCLE.climatology( merged( time =
        (start_time, end_time, 'co')))
# use the defined annual cycle and generate anomalies
merged_an=cdutil.ANNUALCYCLE.departures(merged,ref=ac)
```

7)Â create cdms cariable, write to a NetCDF file

```
# add metadata to the new anomaly variable

merged_an=cdms.createVariable(merged_an,axes=(tim,lat,lon),
          typecode='f',id='anomalies_merged_tas_sst')
merged_an.id='anomalies_merged_tas_sst'
 # Lastly apply the "spatial missing mask" to these data
merged_an=MV.masked_where(MV.equal(mask1,1),merged_an)
```

plot the anomaly merged data

```
y=clear()
y.plot(merged_an)
```

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Now write the data to the NetCDF file we have opened

```
o.write(merged_an)
o.close()
```

The final step is to compare our result with the annual cycle anomaly data from CRU. Here is the plot we made in part I.

You can see that both plots are very symmilar, although you can see some small differences.

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